

PATENT APPLICATION
Application No. 10/709,831
Paper Dated: January 19, 2006
Attorney Docket No. TSENTER.00101

REMARKS

Claims 1 - 10, 17-22 and (new claims 27 and 28)

The Examiner has rejected claims 1-10 under 35 U.S.C. 103(a) as being unpatentable over Kawakami et al. (U.S. 6,683,440) in view of Eguchi (U.S. 5,929,593). The Examiner asserts that Kawakami discloses measurement of battery ohmic resistance (col. 9, lines 36-46) and setting of minimum charging current depending on the battery ohmic resistance (FIG. 6(3)).

Applicant respectfully disagrees. Kawakami does not disclose measurement of battery *ohmic* resistance. Rather, Kawakami discloses measuring *internal* resistance (col. 9, line 41). Internal resistance of a battery includes many components, including ohmic resistance, chemical resistance, and capacitive and inductive reactance. Ohmic resistance is the component of resistance that is devoid of reactance. Kawakami does not teach or suggest separating the ohmic component from the overall measurement of internal resistance. Rather, Kawakami merely describes measuring total resistance by taking the difference between the voltage value at constant charging current and the open-circuit voltage value, and dividing that difference by the constant charging current value. (See col. 16, lines 37-45.) As described in the figures of Kawakami, constant charging current is not reached for at least several minutes after the charging process begins. Such a measurement cannot ignore the non-ohmic components of battery resistance.

In contrast, claim 1 of the present application requires measurement of battery *ohmic* resistance. Claim 27 has been added to further emphasize this difference, as ohmic resistance may be measured as the ratio of a voltage difference to a current difference over a time period between 1 millisecond and 10 milliseconds. Although the invention is not limited to this measurement method, applicant has found that such a measurement within such a time period yields an accurate measurement of ohmic resistance for lithium-ion battery chemistry.

In addition to its failure to teach measurement of ohmic resistance, Kawakami also fails to teach setting a minimum charging current depending on the battery ohmic resistance and the overvoltage protection value. First, because Kawakami does not teach measuring the battery ohmic resistance, it cannot teach a method of setting a minimum charging current

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depending on the battery ohmic resistance. More importantly, Kawakami does not disclose *any* method of setting a minimum charging current at all. The Examiner asserts that Figure 6(3) of Kawakami describes measuring a charge current value over time, and that the text relating to Figure 6(3) (col. 35, lines 17-35) describes changing the charge current curve by increasing internal resistance. However, Figure 6(3) does not describe any method of determining a minimum charging current or other value that is protective of the battery. Instead, Figure 6(3) merely contains inspection results, i.e., the measurements that happen to result when a battery is being charged. No part of Kawakami describes setting a *minimum* charge current value based on *ohmic* resistance or an *overvoltage protection value*, as required by claim 1.

Claim 3 describes an exemplary method of determining a minimum charging current value as a ratio of the minimum overvoltage protection value to the battery ohmic resistance. The Examiner asserts that the Ostergaard (U.S. 5,994,878) discloses this method. While Ostergaard discloses a current that is a ratio of a voltage to a resistance, the current is not minimum charging current, the voltage is not a minimum overvoltage protection value, and the resistance is not ohmic resistance. The resistance values described in Ostergaard include total resistance values for a battery circuit, including not only the battery but also a diode, terminals and other contacts. Accordingly, the voltages described in Ostergaard have nothing to do with a minimum overvoltage protection value for a battery, and the current is therefore unrelated to a minimum charging current for a battery.

In addition to claim 3, claims 2 and 4-10 depend from claim 1 and therefore contain all of the limitations of claim 1. Therefore, for at least the reasons stated above relating to claim 1, claims 2-10 are also patentable.

New claim 27 and amended claims 17-22 also depend from claim 1 and therefore contain all of the limitations of claim 1. Therefore, for at least the reasons stated above relating to claim 1, claims 17-22 and 27 are also patentable.

Claim 11

The Examiner has rejected claim 11 under 35 U.S.C. 102(b) as anticipated by Lundquist (U.S. 6,624,612). The Examiner states that Lundquist, at Col. 4, lines 50-59, discloses a method of Li-based battery equalization wherein an individual lithium cell is periodically

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connected to a battery lithium cell having a minimum discharging voltage until the voltage of the two cells is getting equal to a dynamically preselected voltage.

Applicant respectfully disagrees. Lundquist does not describe any system wherein a battery is periodically connected in parallel to a Li-based battery in order to provide load balancing. Rather, Lundquist describes connecting a complex energy transfer system (Element 12 of figure 1), and then connecting and disconnecting an energy storage device (14 of figure 1) to the energy transfer system. Lundquist does not describe the use of a battery as an energy storage device. Rather, Lundquist describes energy storage device 202 as one or more capacitors (see col. 7, lines 15-16).

In addition, the method claimed in claim 11 provides additional benefits that cannot result from the methods disclosed in Lundquist. For example, the battery additional lithium cell also provides redundancy in battery availability. A battery has much more capacity and long-term storage capability than a capacitor exhibits. The capacitor of Lundquist cannot supply battery redundancy, and Lundquist does not disclose any method or system wherein additional redundancy is supplied. For at least these additional reasons, the teachings of Lundquist are not relevant to amended claim 11, and applicant respectfully requests reconsideration of this rejection.

Claims 13, 14 and 15

The Examiner has rejected claim 13 under 35 U.S.C. 103(a) as being unpatentable over Lundquist in view of Gartstein et al. (U.S. 6,163,131). The Examiner asserts that Lundquist discloses a method of Li-based battery equalization, and that Gartstein generally teaches nickel-metal hydride battery cells. Therefore, the Examiner asserts that it would have been obvious for a person having skill in the art to connect three Ni-based batteries in parallel to a Li-based cell for battery equalization.

Applicant respectfully disagrees. As noted above in the remarks relating to claim 11, Lundquist does not describe any system wherein *any* type of battery is connected in parallel to Li-based batteries in order to provide load balancing. In addition, although Gartstein generally describes Ni-based batteries, nothing in Gartstein suggests that Ni-based batteries (or any other

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types of batteries) may be connected in parallel to a lithium-based battery to provide load balancing or a hybrid power source.

Claims 15-22 depend from claims 13 and 14 and contain all of the limitations of those claims. Accordingly, for at least the reasons set forth above, claim 15 is patentable.

Claims 17-22

Claims 17-22 depend from claim 14 and contain all of the limitations of claim 14. Accordingly, for at least the reasons set forth above, claims 17-22 are patentable.

Claim 23

The Examiner has objected to claim 23 as being dependent upon rejected base claim 14, but the Examiner also indicated that claim 23 would be allowable if rewritten in independent form including all of the limitations of the base claim. Claim 23 is amended herein. However, the original dependence of claim 23 as being from claim 14 was in error. Therefore, claim 23 has been presented herein in independent form and is in condition for allowance.

Claims 24-26

Claims 24-26 depend from claims 1, 11 and 14 and thus contain all of the limitations of those claims. Accordingly, for at least the reasons set forth above, claims 24-26 are patentable.

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CONCLUSION

Claims 1-11, 13-15, 17-19 and 21-26 have been amended, claims 12, 15 and 20 have been cancelled, and claims 27-28 have been added. The amendments do not add new matter. Further, no fee is due because the amendments do not increase the total number of independent claims or overall claims. Based on the arguments and amendments set forth above, applicant respectfully requests that the Examiner reconsider the rejections in this application. If the Examiner has any questions, the Examiner is invited to contact the undersigned attorney James M. Singer at telephone number 412.454.5023.

Respectfully submitted,

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